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7 APRIL 1987

## Worldwide Report

# TELECOMMUNICATIONS POLICY, RESEARCH, AND DEVELOPMENT

**FBIS**

FOREIGN BROADCAST INFORMATION SERVICE

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7 APRIL 1987

WORLDWIDE REPORT  
TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

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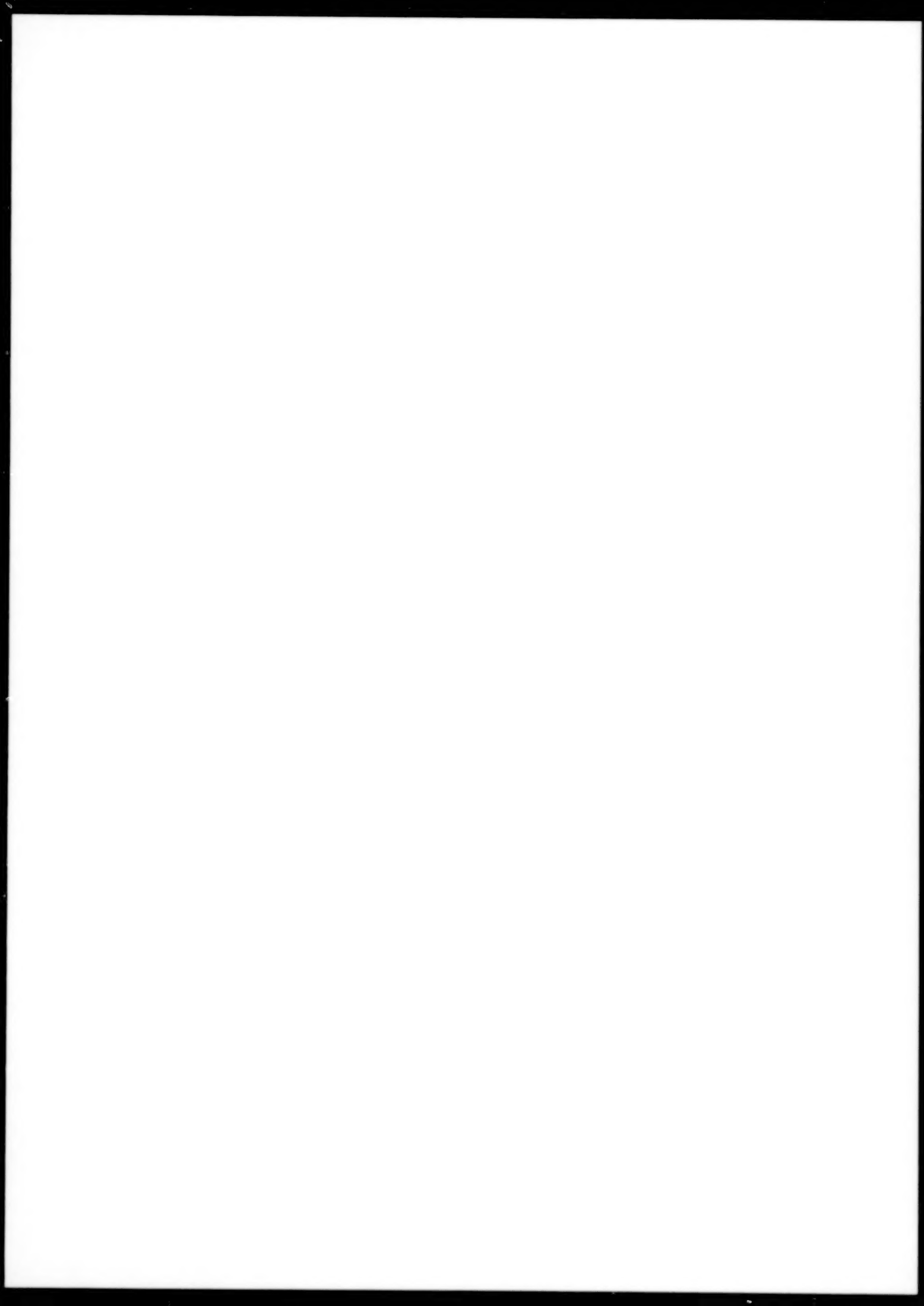
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TELEX SUPPLIERS CHALLENGE CABLE AND WIRELESS 'MONOPOLY'

Hong Kong SOUTH CHINA MORNING POST in English 18 Feb 87 Supplement pp 1, 8

[Article by Olivia Sin]

[Text]

TELEX machine suppliers are pressing the Hongkong Government to set up an independent body to approve the installation of their equipment.

Under the present system, they have to seek approval from Cable & Wireless, which dominates the local telex machine market and holds a monopoly as operator of the telex network.

A senior Post Office official said yesterday that several parties were being consulted on the question of creating an independent panel.

C & W responded by saying the company did not mind delegating the responsibility to a third party so long as it could make sure that the equipment installed was up to standard and was compatible with the network.

Leading the campaign is Arnhold and Co, the local agent for SAGEM (a leading French telecommunications equipment manufacturer) which said it was unfair that it should have to seek approval from its competitor.

"Unless the regulation is changed, it will give C & W information that we fear to give them," said Arnhold's managing director, Michael Green.

He added that the company was "scared" about launching an innovative Chinese-language telex service in Hongkong in view of C and W's "monopoly" position.

"In most countries, telex messages are controlled by public utilities and the machines can be obtained in the open market. Why should C & W have both?" asked Mr Green.

Before 1983, Cable & Wireless had complete control over Hongkong's telex network and the sale of telex machines.

In 1983, the Government deregulated the distribution of telex machines but new suppliers have to submit their equipment to C & W for approval.

The Assistant Postmaster General, Telecommunications, F.H. Wise, said Britain was one of the few countries to have set up an independent body to vet telex equipment applications.

The Hongkong Government was considering whether it was desirable to follow suit.

Financing such an operation would be a major problem, he said. "Who is going to pay for it? The Government is not going to pay."

C & W's divisional manager for text services, David Lawrence, agreed that the technical facilities involved in the proposal would be expensive.

Mr Wise said the Government had held discussions with the Hongkong Telecommunications Association and Consumer Council to see

what kind of improvements should be made to the existing control over telecommunications.

He was not convinced, he added, that telex machine suppliers were suffering from unfair competition.

Defending the Hongkong practice, he said most European countries operated their telex network services on a similar system.

The Post Office in Hongkong has no operational role in the provision of telex services except that it approves the charges levied by C & W for the service.

According to Mr Law-

rence, Hongkong has about 29,000 telex machines, of which 28,000 were installed by C & W. The remaining 1,000 were supplied by other manufacturers.

SAGEM, short for Societe d'Applications Generales d'Electricite et de Mecanique, is a major manufacturer in telecommunications and industrial equipment in France.

It has signed a co-operation agreement with the Chinese Ministry of Posts and Telecommunications to develop a Chinese-language telex machine, which will facilitate communication between

various provinces and cities in China. Arnhold also has a stake in the project.

Mr Green said engineers from SAGEM were working with the Ministry in Guangzhou to develop Chinese-language telex machines on a commercial basis.

"The technology is ready in China," he said, adding that the company had started marketing the equipment there.

In view of the increasing interaction between Hongkong and China, Mr Green saw good market potential in launching the new telex service in the territory.

Cable & Wireless is also looking at the possibility of introducing the Chinese-language telex services in the territory. Mr Lawrence said the difficulty was finding a suitable way to enter the Chinese characters, numbering more than 3,000, into the telex machines for efficient codification.

He said staff with a high level of training would also be needed to operate the service. A separate "packet" network would have to be installed for the transmission of telex messages in Chinese characters.

/9274

CSO: 5550/0104



MOBILE DATA SERVICE

Hong Kong HONGKONG STANDARD in English 7 Feb 87 p 3

[Text]

THE Government is calling for applications to operate the territory's first mobile data communications service which will enable flexible access to information sources through a radio system.

The concept behind this state-of-the-art service is similar to mobile telephones, except that the message is data not voice.

The service is expected to give commercial and individual users more flexible information links than present data transmission services, such as the electronic mail-box, which are carried over telephone lines.

The Government is also inviting applications to operate a fourth mobile telephone service.

Senior Controller of Telecommunications, Dr Norman Wai, told *The Standard* yesterday the mobile data communications system would involve a capital outlay of at least \$50 million.

Users must possess a mobile or portable data terminal (similar to computer visual display terminals) which is connected to a wireless transmitter/receiver.

This will enable the sending and receiving of data from information sources from almost any point in Hongkong.

Like mobile phones, it will also be possible to install the system in vehicles.

BRIEFS

DALIAN FIBER OPTIC SHIP MONITORING--Dalian, 25 Feb (XINHUA)--Dalian, a port in northeast China's Liaoning Province, has installed a new optic-fiber system to monitor the movements of oil tankers. A port official said, "Dalian's system is the first used in China to monitor the arrival, loading and departure of oil tankers." Dalian's oil port, the largest in China, has an annual handling capacity of 105 million barrels. "The dock which handles oil tankers is 1.5 kilometers from shore," the official said, "an previously, monitoring was done manually with binoculars and often errors were made." "Dispatchers now observe the work site on a screen and can relay orders over the system," he added. [Text] [Beijing XINHUA in English 0213 GMT 25 Feb 87 OW] /6662

FUJIAN'S FAST INTERNATIONAL MAIL SERVICE--Fuzhou, 5 Mar (XINHUA)--Six cities in southeast China's Fujian Province can now deliver letters and small parcels all over the world in record time, postal officials said here today. Fast delivery of documents to the United States requires three days and to other countries no more than five. To ship small parcels under the service requires an additional one or two days for customs inspection, they said. The new service, co-sponsored by the China Fast Delivery Service Company and an American firm, is computerized and uses special planes and cars for delivery. The service is now available in Fuzhou, the provincial capital, Xiamen, Zhangzhou, Quanzhou, Sanmin and Nanping. [Text] [Beijing XINHUA in English 1318 GMT 5 Mar 87 OW] /6662

FIRST GROUND SATELLITE COMMUNICATIONS STATION--Beijing, March 10 (XINHUA)--The Juiquan Satellite Launching Center in northwest China's Gansu Province now boasts China's first ground satellite communication station, today's LIBERATION ARMY DAILY reported. "The new station, approved last week by the international telecommunication ground satellite organization, will be connected with the existing international network," according to the report. This station is the first among those already operating in the space communication network, and satellite launching centers, observation and monitoring centers and space survey stations are also scheduled to be built. Expected to replace the old radio and short-wave communication facilities, the newly-built station will improve efficiency and the quality of satellite launching and observation system, the report said. [Text] [Beijing XINHUA in English 1315 GMT 10 Mar 87 OW] /6662

SHANXI IMPROVES TELECOMMUNICATIONS SERVICES--Taiyuan, March 11 (XINHUA)-- Shanxi Province, China's leading coal producer, now offers telephone subscribers in its capital direct-dialing service to 100 cities nationwide, a local official said. "The city also provides a paging service which is operable within a 30 kilometer radius and so far the service has 318 subscribers," the official said, adding express facsimile service from Taiyuan to all other cities and regions of the country is now available. The provincial Posts and Telecommunications Bureau imported a computer-controlled switchboard and telegram transmitter from Switzerland in 1985, so now urban telephone subscribers can dial directly to more than 100 foreign countries. Now posts and telecommunications services are available in almost every village and at 5,500 peasant mines in the province, even though 80 percent of the province is mountainous, the official said. To date, 142 postal savings banks have been set up at the county level where savings deposits totalled 20 million yuan (5.4 million U.S. dollars) at the end of last year. [Text] [Beijing XINHUA in English 0133 GMT 11 Mar 87 OW] /6662

CSO: 5500/4150

## INTERNATIONAL AFFAIRS

### BRIEFS

**GDR-INDIA TELEVISION AGREEMENT**—An agreement on cooperation in the sphere of television was signed in Berlin on Thursday [29 January] by Heinz Adameck, chairman of the State Committee for Television attached to the GDR Council of Ministers, and Prem Kumar Budhwar, ambassador of the Republic of India to the GDR, thus continuing the contractual relations that have existed for many years. Among other things, the agreement provides for the exchange of programs, assistance in reporting on current affairs, and mutual exchanges of experience. [Text] [East Berlin NEUES DEUTSCHLAND in German 30 Jan 87 p 2] /9604

**GDR-INDIA RADIO AGREEMENT**—East Berlin (ADN)—On Wednesday [21 January] Rolf Weissbach, deputy chairman of the State Committee for Radio at the GDR Council of Ministers, and Prem Kumar Budhwar [spelling as published], ambassador of the Republic of India to the GDR, signed in Berlin an agreement on cooperation in the area of radio. This renews the long-standing contractual relations between Radio GDR and All India Radio. The agreement envisages, among other things, the exchange of material for programs, mutual support in reporting, and cooperation in the advanced training of journalists. [Text] [East Berlin NEUES DEUTSCHLAND in German 22 Jan 87 p 2] /9604

CSO: 5500/3012

PLANS FOR 'INMARSAT' GROUND STATION AT PSARY

Warsaw KURIER POLSKI in Polish 11 Dec 86 p 3

[Article by Wojciech Swiecicki: "Ocean Communications Via Satellite; INMARSAT Is For Ocean Fleets and Airlines; Psary Presently In World System; Standard C Obligatory in 4 Years"]

[Text] The international maritime satellite organization INMARSAT has been functioning since February 1982. Satellite communications is in operation in the Atlantic, Pacific and Indian Oceans. It is based on six satellites orbiting in pairs over each ocean and 16 ground stations located on five continents.

The number of stations is increasing constantly. The operating effectiveness and excellence of this telex, telephone, facsimile, TV and rescue communications system are improving. Its services are used by modern ships—large tankers, gas carriers, container ships, large fishing vessels, oil drilling rigs, passenger ships, scientific research vessels, ice breakers and many others. Already 5,000 floating customers utilize INMARSAT, including 16 Polish-flag ships. Within the next 6 months, probably at the end of the 1987 first quarter, Poland will place its own ground station in operation in Psary, near Kielce.

This ground station will improve significantly domestic telecommunications to the Indian and Atlantic Ocean areas. It also will provide service to these areas for other European countries. The Psary station operation will enable the Office of Maritime Economy to finance INMARSAT services for the Polish fleet and, beginning in 1987, for LOT.

In 2 years, INMARSAT will cover practically the entire globe and will also be used for airline communications, thanks to expanded worldwide cooperation and the projected use of 9 satellites. Currently the satellites do not cover all regions of both poles. The signals can be received at angles exceeding five degrees. Thus, right now, it is a 5-continent system, continents on which the stations operate by mutual agreement near the coasts. Our Psary is located in the Holy Cross Mountains, 500 km from the sea. However, Psary's antenna will cover ideally both oceans on which Polish merchant and fishing ships primarily operate.

For ships equipped with the proper terminal, INMARSAT assures automatic telex and telephone communications regardless of time of day or year. The system transmits data at a rate of 56,00 to 1 million bits per second. It can transmit all information concerning, for example, ship cargoes and routes; it can create lists sent by fleet owners and agents and, in turn, transmit all information from the ship.

The Queen Elizabeth II receives photos and films from two American stations, showing these photos and films directly to TV viewers on the ship or recording them on video cassettes when the passengers are asleep.

New intersatellite communications equipment is being produced by two American firms and 10 subcontractors in the United States, Great Britain and Japan. INMARSAT's latest goal is to miniaturize the equipment for installation on smaller ships. This equipment will be more reliable, faster and easier to operate. This innovation is known as the Standard C Terminal. It will transmit and receive only digital data and printed matter. After 1990, it will be required equipment for all ships greater than 300 brt.

Standard C equipment consists of a small typewriter weighing 6 kg and an antenna shaped like a rolled canister that is 6 cm in diameter and 10 cm high. This small and very practical equipment will automatically tune to and select SOS signals. It will be used to record all port, forwarding and cargo operations, information concerning freight charges, economic data and even voting results. This equipment permits conferences to be conducted in writing among ships at sea without telephony. Literally all land-based firms and organizations with the need to maintain operating contact will be able to communicate with ships at sea.

Already INMARSAT is providing invaluable service to sailors, increasing their efficiency and improving the safety of sailing. And starting in 1988, it will enable safer flights.

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CSO: 5500/3011

FIBER OPTIC PHONE LINES IN SERVICE IN LODZ

Lodz GLOS ROBOTNICZY in Polish 11 Dec 86 p 3

[Article: "Reliable Communications; Three Fiber Optic Lines Already In Service In Lodz"]

[Text] A fiber optic telecommunications line has been in service for 5 years in Lodz between Widzew and Dabrowa. The 5.2-km line has proven itself in service: it is reliable, immune to interference and will not corrode. About 1,000 subscribers have used it to date. This year two additional fiber optic lines have been installed--between the Centrum and Poludnie telephone exchanges and between the Poludnie and Dabrowa telephone exchanges. The lines will be placed in service after equipment essential to fiber optic operation is installed during the first half of 1987. In addition two more fiber optic lines will be installed in 1987.

Thus, Lodz will be the only city in Poland to have 5 operating fiber optic lines. It is true that it is an expensive investment, but in the final analysis it will be exceptionally profitable because very little money will be required for regular maintenance and repair of line defects, and it will not be necessary to build special reclamation wells that are required to operate "normal" telephone lines.

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WROCLAW SCIENTISTS BUILD 'METEOSAT' GROUND STATION

Wroclaw GAZETA ROBOTNICZA in Polish 20-21 Dec 86 p 5

[Article: "Pictures From An Altitude of 36,000 km; From Satellite to Wroclaw"]

[Text] Specialists from Wroclaw Polytechnic built a station to receive satellite data that will be able to provide weather pictures from a Meteosat geostationary satellite orbiting synchronously at an altitude of 36,000 km around the Earth and located at the equator and prime meridian.

"This station," says Dr Eng Wlodzimierz Marek Baranski of Wroclaw Polytechnic's Institute of Engineering Cybernetics, "consists of several units, including a 3-meter diameter antenna, converter, receiver and computer with monitor on which prepared photos can be received in color or black and white. These photos will be similar to the one we see on the TV weather news that are produced in and transmitted from Czechoslovakia."

The station is the work of professionals from Wroclaw Polytechnic's Institute of Engineering Cybernetics and Institute of Telecommunications.

"The station is installed here," says Magister Ryszard Dyczkowski, director of the Wroclaw Forecasting Office. "We are waiting for the computer and monitor which are supposed to be delivered in the next few days. Next year the equipment should be in service. We will have photos and more data enabling us to forecast weather in southwest Poland more accurately, especially for Lower Silesia."

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CSO: 5500/3011



## KRAKOW POSTAL, TELEPHONE PZPR UNIT LOOKS AT SYSTEM

Krakow ECHO KRAKOWA in Polish 1 Dec 86 p 1

[Article: "We Are Linked With 12 Countries Via An Automatic Telephone Exchange"]

[Text] Today over 60,000 people are waiting in Krakow for a telephone. Though the number of telephones available annually is increasing (1,500 new telephones in 1980 and 10,000 this year), the number of people wanting telephones is not diminishing. In the next 5-year period it is projected that the number of telephones will double, that is, about 50,000 new telephones will be installed. Is that enough?

The expansion of Krakow's telecommunications was discussed at Saturday's 16th report-back conference of plant party organizations of the Krakow Postal and Telecommunications District Directorate [DOPiT]. Jerzy Dabrowski, the PZPR plant committee first secretary, whose present term is expiring, discussed in a paper all aspects of political work. He said, among other things, that 65 comrades left the party organization, 47 because of job changes.

In the last several years, 21 new party members were inducted, most of them from primary party organizations within the District Intercity Telecommunications Administration, that is, eight individuals. Eight people were given their party cards at the Saturday meeting.

During the discussion, much attention was devoted to expanding communication resources. Much has been accomplished, especially in Krakow. Telecommunications expansion, however, is being hindered by shortages of telephone exchanges and cables. We are importing telephone exchanges from Hungary and, lately, Yugoslavia.

Despite these difficulties, we have managed to double the capacity of the automated long distance telephone exchange. Today Krakovians can dial directly to 12 European countries and over 600 localities in Poland. J. Dabrowski was re-elected DOPiT PZPR Plant Committee first secretary.

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CSO:5500/3011

## BRIEFS

**NEW ANTENNA SYSTEM**--Cable and Wireless has installed a 7.5 metre transportable antenna system in Belmopan alongside the main 13-metre Belmopan antenna dish, says a release from Cable and Wireless. The release adds that "the temporary dish carried C & W's International Telephone, Telex, Telegram and Leased Services while C & W engineers from London replaced major components on the 13-metre dish. This work was necessary to ensure that Belmopan will be able to operate with the new generation of satellites, to be put into service by the governing body for satellite operations INTELSAT, in 1988. [Text] [Belize City THE BELIZE TIMES in English 22 Feb 87 p 5] /9274

CS0: 5540/073

## CONTRACT FOR TRANSATLANTIC COAXIAL CABLE AWARDED

Hamilton THE ROYAL GAZETTE in English 10 Jan 87 p 2

[Text]

An international private consortium yesterday signed a \$350 million contract for a transatlantic co-axial cable which will bring Bermuda into the 21st century of telecommunications.

Cable & Wireless (Bermuda) Ltd. and Private Transatlantic Telecommunications System (Bermuda) Co. signed the contract with British cable-laying company Stantel Submarine Systems.

Stantel will lay a 3,730-mile cable called PTAT-1 from the United Kingdom to Long Island, New York, which will include a 620-mile spur to Bermuda. The system is expected to be completed by mid-1989.

The cable spur, which was negotiated largely by former Minister of Technology the Hon. John Stubbs, will increase Bermuda's telecommunications capacity well beyond what exists presently and will also give Bermuda a direct link to Europe for the first time.

And he said if Bermuda is able to use the capacity, Cable & Wireless could also extend the line to the Caribbean, making Bermuda a

major telecommunications staging post.

A Cable & Wireless statement said: "The spur linking Bermuda into PTAT-1 will provide the Island with very considerable international digital transmission capacity facilitating the provision of high speed data links, telephone circuits of the highest quality and an alternative medium for video transmissions."

Dr. Stubbs said the primary benefit for most Bermudians will be improved overseas telephone quality and possibly cheaper rates.

In addition, transmission of computer language will be made much easier.

Dr. Stubbs said it first became likely Bermuda would become linked with a transatlantic cable when Bermuda was negotiating a new agreement with Cable & Wireless.

Cable & Wireless chairman Sir Eric Sharpe was told of Bermuda's interest and became a backer of Bermuda being given a spur of the PTAT line, Dr. Stubbs said.

/9274

CSO: 5540/074

DIGITAL PHONE SYSTEM FIRST STEP IN WIDESCALE PROGRAM

Road Town THE ISLAND SUN in English 28 Feb 87 pp 1, 2, 7

[Article by Vernon Pickering]

[Text]

The new digital telephone exchange serving the British Virgin Islands was officially inaugurated on February 20th by the Chief Minister of the Government of the BVI The Honourable H. L. Lavety Stoutt.

Mr. Stoutt was accompanied by other members of the Government and distinguished guests. Tom Chelley, executive director responsible for the Caribbean region, represented Cable & Wireless, who operate the island's internal and external telecommunications.

With the installation of the new exchange, telephone customers in Tortola will now be able to dial all major countries of the world directly, using the international direct dialling (IDD) facility. The exchange forms the first phase of a digitalisation programme which will extend throughout the British Virgin Islands in the coming months.

The inauguration is an important event in the development of telecommunications in the BVI

It marks the successful completion of the first stage Cable & Wireless's \$20M development programme for the BVI.

The contract for the new exchange was signed in October 1985, when the Government extended Cable & Wireless' operating licence for a further 20 years.

Further stages of the digitalisation programme will be completed by the end of 1987 to extend the digital telephone network to other islands such as Virgin Gorda and Anegada. Smaller islands and isolated communities within the BVI will be served through the soon to be commissioned polled radio-telephone system, currently being installed in the islands (Jost Van Dyke is scheduled for next year).

The introduction of digital technology in the island will provide faster and more dependable connections with higher quality transmission. Digitalisation will bring itemised billing of international calls and the technology can also provide value added telephone services and many other enhancements.

New links, using digital transmission equipment, will connect BVI to the other islands of the Caribbean. The international system will be compatible with new and planned switching systems being installed by Cable and Wireless throughout the Caribbean in a \$200M digitalisation programme which will take the region's telecommunications into the 21st century.

/9274

CSO: 5540/075

## JAPANESE TEAM ASSISTS WITH GTC'S NEW EXCHANGE SYSTEM

Georgetown GUYANA CHRONICLE in English 11 Feb 87 p 1

[Article by George Barclay]

[Text]

THE \$5m(US) twin exchange system recently acquired by the Guyana Telecommunication Corporation (GTC) which provides for international distance dialling and computerisation of the operators service could also accommodate a mobile

telephone service among other things.

This was disclosed yesterday by Mr. Yoshiteru Yamamoto, Manager — Telecommunication Projects, Electric & Electronics, Department of NISSHO Iwai America Corporation (NIAC) who is here to attend the preparatory meeting prior to the installation of NEAX 61 — the new twin exchange system.

NIAC is the trade firm that was contracted by the Guyana Government to provide the new exchange.

Also here in the country with Mr. Yamamoto is Mr. Kaneo Chikada of NEC (Nippon Electronic Corporation) the manufacturers of the new exchange.

NEC is the same company that supplied the Earth Station to Guyana in 1979 and reports state that it is still giving excellent service.

Mr. Yamamoto who has already had talks with Guyana Telecommunication's General Manager Michael Welch, and Manager of Research and Development, Hilton McAllister and other Telecoms top officials will leave the country on Friday for New York after what he described as a "successful meeting."

Mr. Chikada who will head a seven-member Japanese team of technicians that will be responsible for supervising the installation work will shortly be joined by his team-mates.

He told the Chronicle that preparatory work has begun and that the installation exercise will begin in another two weeks. According to him, the project which will attract about 30 technical and administrative personnel, will take about five months to be completed.

The Japanese technician agreed with the observation by Mr. Yamamoto that the project is an open one that provides for programming and a change of features without having to purchase expensive equipment. He also agreed that the project has room to accommodate a mobile exchange.

General Manager Welch said that the Corporation was very happy to have contracted the services of NEC because that corporation is one of the leading manufacturers in the world for the particular type of technology.

He expressed confidence that the new equipment will prove its reliability and that the Guyanese people will be satisfied with the service.

The General Manager explained that the NEC's policy on installation is to allow the staff of the recipient country to get as much exposure as possible to the equipment. Therefore, he noted, it was decided that there will be only one supervisor and six specialist engineers from Japan engaged in the installation work. All the other personnel will include Guyanese technicians and engineers.

## INTELSAT OFFICIALS APPROVE MONTEGO BAY TELEPORT PROJECT

Kingston THE SUNDAY GLEANER in English 22 Feb 87 p 1

[Text] Prime Minister the Rt Hon Edward Seaga has announced that Jamaica's teleport project has received approval from the Board of Governors of INTELSAT, the international telecommunications regulatory body.

The teleport, which will be sited in the Montego Bay Free Zone, will provide a new range of service industries for Jamaica through the establishment of off-shore offices by American businesses which will communicate with their headquarters by satellite transmission.

The teleport will offer voice, video, and data communications between North America and users in the Montego Bay Free Zone who lease these transmission facilities.

These services, some of which will be linked to the "800" lines in the United States will also be offered to users in other areas of Jamaica who would be connected to Montego Bay by lines from the Jamaica Telephone Company.

The teleport will also introduce high-speed data transmission which transmits at a rate of 30 type-written pages in one second and at a much cheaper rate than the normal data communication now available.

The teleport would provide this

service to clients on a basis of leased-lines and will therefore offer different services to those now offered by the Jamaica International Telecommunications Limited (JAMINTEL).

The teleport project was outlined by Prime Minister Seaga in the 1986/87 Budget presentation. The project was developed with foreign joint-venture partners by a Jamaican team spearheaded by the Jamaica National Investment Promotion Limited and which included the Ministry of Public Utilities and Transport, the National Investment Bank of Jamaica, the Attorney General's Department, and the Office of the Prime Minister.

Shareholders in the teleport include two major Japanese companies and two American entities. The Jamaican Government will also be an equity participant in this venture through JAMINTEL and the Jamaica Telephone Company.

Engineers are currently in the island concluding development and infrastructure plans for construction of the buildings which will

house the teleport's clients.

When fully operational, in three to four years, the project is expected to employ approximately 10,000 people, providing significant employment in Montego Bay and other locations of data entry companies, the Prime Minister.

The establishment of the teleport is also expected to act as a catalyst in fostering the greater expansion of the data entry industry which has recently grown to employ more than 3,000 people islandwide, he noted.

Mr. Seaga added that, having been passed by the Board of Governors of INTELSAT, the project will go to the Assembly of Parties (countries which are members of INTELSAT) for the formality of approval at that level. This is expected to take place in April.

Thereafter, the U.S. Federal Communications Commission and the Jamaican Government will give their final approval to the venture.

On this basis, the teleport could become operational in the third quarter of this year.

/9274

CSO: 5540/077

## OPPOSITION ASKS EQUAL TIME IN ELECTION CAMPAIGN

Bombay THE TIMES OF INDIA in English 18 Feb 87 p 9

[Text]

The Times of India News Service  
NEW DELHI, February 17.

**T**HE opposition parties want equitable allocation of time on radio and television for campaigning during the forthcoming assembly elections.

Spokesmen of the BJP, Lok Dal, CPI(M) and Janata Party have claimed that the abuse of the electronic media rendered the elections unfair. The high incidence of illiteracy in the country enabled radio and television to serve as the main source of news for the people.

Since the electronic media was heavily loaded in favour of the ruling party at the Centre and an adequate opportunity was provided to the opposition parties to put across their view point, it made the electoral battle unequal.

Under the existing system, each party was given a 15-minute slot only once during the election campaign to put across its message on the electronic media. But the propaganda of the ruling party almost never ended, the spokesmen said. They demanded that this imbalance should immediately be corrected.

The President of the BJP and former minister for information and broadcasting, Mr. L. K. Advani, pointed out that the electronic media did not ignore the Vijayawada session of his party. But maximum coverage was given to the critical references made by his party to the Telugu Desam government. All critical references to Mr. Rajiv Gandhi and his government were totally eliminated. The government would, however, claim that the

BJP was given time on the electronic media.

## AUTONOMY OF TV

The remedy was autonomy of TV and Air. But the first government after independence to reject this demand was the one led by Mr. Gandhi. He said he did not want the radio and TV to become "as irresponsible as the press." This was basically an anti-democratic attitude, Mr. Advani pointed out.

He wanted a cell to be set up in the election commission which would monitor all material with any kind of bearing on political affairs being used by the electronic media during the election campaign. "This is not a solution", he said, but it would serve as a kind of deterrent in much the same way as an observer sent by the election commission to a constituency.

The spokesman of the CPM, Mr. Harkishen Singh Surjit, however, saw no merit in the suggestion since his party believed that there had been serious erosion in the independence of the election commission. Three months ago, the West Bengal government had said it wanted elections in February, but the commission did nothing.

However, elections in Haryana were postponed. He was in favour of giving equal time to all parties. Let there be a debate on the electronic media during which charges and counter-charges are made by the participants, he said.

Mr. Surjit said that the electronic media was being used to distort public opinion. While opposition parties got only one chance, the Congress kept on making favourable propaganda. In the interest of fair elections, that aspect had to be taken seriously.

/9274

CSO: 5550/0097



# PROTOCOL ON TELECOMMUNICATIONS SIGNED WITH SOVIET UNION

New Delhi PATRIOT in English 16 Feb 87 p 3

[Text]

India and the Soviet Union will promote and expand telecommunication links between them through telephone, telegraph and telex services and extend them to industrial and other projects under a protocol signed in New Delhi on Sunday.

Full scale international subscriber dialled telephone service between the two countries will be expanded, direct circuits increased to meet demand and they will assist each other in providing telecom traffic transit to some third countries.

Under the protocol, the two governments will promote technical support to the Festival of India in the USSR and the Festival of USSR in India in 1987-88 and other bilateral events in the future.

The two countries will explore the possibilities of setting up automatic transit of telephone calls to third countries via India and the USSR and prepare concrete action plan on extending telecom facilities to projects, by the end of the current year.

The projects over those constructed or operated on the basis of inter-governmental agreements on the territories of the two countries.

The telecom links will include leasing of communication channels to users.

They will jointly study the

technical and economic aspects of telecom development by means of the satellite communication system.

The protocol was signed for India by Mr D K Sangal, secretary in the department of telecommunications and for the Soviet side by Mr G G Kudriavtsev, first deputy minister of posts and telecommunications.

Under the protocol, the two governments will elaborate and coordinate technical proposals on the lease of Soviet communication satellite transponders to India.

They will examine the status of communication technology and industry in both the countries for long term cooperation in use of components manufactured by the two countries. Joint development and production of communication equipment. Supply and sale of equipment to each other and to third countries.

Joint manufacture of communication equipment.

Participation in the construction of communication projects for third countries and joint projects for scientific research and training.

They agreed to prepare and coordinate in 1987-88, a joint programme of research of wave propagation in the 10-30 ghz frequency band at the USSR international centre (Dubna) and to

discuss the possibilities of setting up a testing ground station in India.

Noting the common need to expand telecommunication network and the possible benefit of exchange of experience in this field the two sides agreed to have a broader exchange of information on the strategy and technology accepted in both countries and to study the possibility of joint development of technology and production in this field.

For this purpose, before the next bilateral meeting, the two governments agreed to further explore the possibility of cooperation in manufacture of microwave relay equipment and digital aerial line carrier systems.

Manufacture of antenna for satellite communication systems.

Joint cooperation in the manufacture of cable pressuring equipment and rectifier unit and mechanisation of cable laying equipment.

The two governments shall promote the expansion of business contacts between enterprises and specialists to acquaint each other with the operation of communication facilities and enterprises of both sides, sharing work experience and exchanging scientific and technological information in the telecom field.



## ALCATEL INDIA TO ENTER DEFENSE TELECOMMUNICATIONS

Calcutta THE TELEGRAPH in English 13 Feb 87 p 8

[Text]

New Delhi, Feb. 12: Alcatel India, which till now had primarily been involved in the area of digital switching, is planning to diversify into defence telecommunications with the public sector Bharat Electronics Limited (BEL), as well as consumer telecommunication facilities such as facsimile, terminal units, etc and components in collaboration with private Indian companies.

The chairman of Alcatel India, Mr Philippe Humbert, said "We have four or five proposals from Indian companies, which we are discussing. We are not far away from finalising agreements, which will be simultaneously for joint ventures with equity participation and technology transfers."

The director general of CIT-Alcatel, Mr Pierre Guichet said Alcatel was keen on collaborating financially in the areas of switching and transmission, which accounts for 90 per cent of the total outlay on telecommunications. As these areas were reserved for the public

sector companies like ITI, BEL and ECL, the company could participate only in joint ventures for manufacture of components and terminals.

Drawing attention to the scope for development of software in India, Mr Guichet disclosed that Alcatel was holding discussions on setting up a software centre in this country, which would export applications to the parent company's research and development centre in France.

Mr Guichet told The Telegraph that Alcatel would like to invest even in operating companies like the newly formed Mahanagar Telephone Nigam. However, this area was also closed to it at present.

At the fourth plenary session of the 29th International Chamber of Commerce on computerisation and telecommunications, Alcatel, Siemens and AT and T were all represented by their top executives. The president and chief executive officer of AT and T, Mr John E. Berndt, and Mr Ernst Gerhardt, member of the executive board of Siemens, were on the panel.

"The challenge to AT and T and other members of the industry is to provide customers with the kind of networking capability, flexibility, compatibility and ease of use that will enable them to link whatever people and machines they wish to, wherever they may be, and to be able to move whatever information they wish in whatever form they wish while providing the necessary level of security," Mr Berndt said.

Mr Guichet said all the major telecom equipment suppliers recognised the need for standardisation, which would benefit both manufacturers and users since it would enable mass production at lower prices.

The giant AT and T International (US) is understood to be interested in a share of the rapidly growing telecommunications scene in this country. However, the fact that it has joined the race a little late might affect its chances to a certain extent, sources said. Two other international heavyweights, Siemens AG and Alcatel have made their entries.

/9274

CSO: 5550/0095

## REORGANIZATION OF TELECOMMUNICATIONS PLANNED

New Delhi PATRIOT in English 21 Feb 87 p 5

[Text]

The Department of Telecommunications would reorganise all telecom circles and major and minor telephone districts using secondary switching areas as the basic units of management, an official press release on Friday said.

Secondary switching areas are areas demarcated under the national telephone switching scheme and each area generally consists of one or two revenue districts.

Under the reorganisation scheme, each secondary area would have a telecom district. The rank of the officer in charge of the telecom district would depend on the work load in the area, the release said.

A telecom district would have independent status as long as the rank of the officer in charge was that of senior time-scale officer, a junior administrative grade officer or a senior adminis-

trative grade officer as justified by workload in each, the release said.

If, however, the workload in some of the telecom districts was insufficient to justify the appointment of an independent telecom district engineer, then a few of them would be grouped together. If there was expansion in any of the telecom districts so grouped to justify an independent telecom district engineer, then such districts would be separated and placed under an independent officer, the release said.

Under the scheme, opening of new telegraph engineering divisions of telephone divisions would not arise as all new management units would be telecom districts only. To cater to the needs of organisational expansion, the status of the officer in charge would be raised as and when there was adequate growth and development.

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CSO: 5550/0099

## SEVENTH PLAN PROVIDES FOR MORE RADIO STATIONS

New Delhi PATRIOT in English 14 Feb 87 p 5

[Text]

Thirtyeight more radio stations are to be set up in the hilly areas of 14 States in the country during the seventh Plan period, substantially increasing the air coverage in these areas, reports UNI.

A large number of high and low power television transmitters will also be set up in these areas in the range of ten kw and one kw, and 100 wats respectively during this period.

Six radio stations will be set up in Himachal Pradesh, five each in Uttar Pradesh and Maharashtra, four in Jammu and Kashmir, three each in Tamilnadu, Karnataka, and Kerala, two each in Tripura and Assam and one each in Manipur, Meghalaya, Nagaland, Arunachal Pradesh and Mizoram.

With this addition, 95 per cent of the population in Jammu and Kashmir will be brought under the air coverage. The present coverage is only 85 per cent. The increase in coverage will go up from 75 to 96 per cent in Himachal Pradesh, from 90 to 97 per cent in Nagaland, from 96 to 99 per cent in Tripura, from 81 to 96 per cent in Meghalaya, from 74 to 80 per cent in Sikkim, from 75 to 98 per cent in Arunachal Pradesh and from 82 to 95 per cent in Mizoram.

The total air coverage in Assam will go up from 35 to 99 per cent, Tamilnadu from 81 to 99 per cent, Uttar Pradesh from 40 to 98 per cent, Kerala from 83 to 99 per cent, Karnataka from 60 to 96 per cent and Maharashtra from 83 to 99 per cent.

The TV coverage in Tamilnadu will increase from 86 to 88 per cent, in Uttar Pradesh from 84 to 92 per cent, in Kerala from 77 to 85 per cent, in Goa from 92 to 97 per cent, in Karnataka from 48 to 66 per cent and in Maharashtra from 57 to 78 per cent.

## TELECOM DEPARTMENT PLANS FOR NATIONAL COMPUTER NETWORK

Calcutta THE TELEGRAPH in English 28 Feb 87 p 5

[Text]

New Delhi, Feb. 27 (UNI): The department of telecommunications (D.T.) has approved the use of satellite communication, VHF radio and dial-up access for its national computer network, Indonet.

With this, phase II of the project is now cleared for implementation and is expected to be completed in mid-1988, according to Dr P. P. Gupta, chairman and managing director of CMC Ltd, a public sector undertaking.

In phase II, coverage of Indonet would increase from eight to 35 cities, he told newsmen. The state of art technique (TDM/TDMA) would lead to optimal use of satellite space.

This technique, together with the use of the three-metre rooftop earth station, would lead to a cost effective and highly reliable backbone network, he added.

Data transmission would take place at 64,000 bits a second, a 30-fold increase over what was currently available.

The "last mile" problem of leased lines, which involved data being corrupted as it traversed through various telephone exchanges, would be eliminated in phase II, as data would come directly from the satellite to the earth station at the Indonet centre, Dr Gupta said.

CMC was pioneering the "digital packet radio" technology in phase II, in which inexpensive radio-cum-data equipment would replace intra-city lines. With this equipment many users can simultaneously utilise a single VHF radio frequency for two-way data communications.

In phase II of Indonet, users would be able to access special-

ised software packages and data bases on technical, legal, agricultural, medical and corporate topics from their premises. Users of this service would be from research institutions, design laboratories of large corporations, publishing houses, courts and hospitals.

Use of dial-up facilities in cities like Bombay and Delhi would allow infrequent users to also utilise Indonet services as charges would be levied only on the basis of each call.

Today, a large number of public and private sector organisations are utilising Indonet. They include the Oil and Natural Gas Commission, Shipping Corporation of India and the Steel Authority of India. The State Bank of India is using Indonet for its foreign exchange operations.

Dr Gupta said CMC has signed an agreement with Coal India Limited (CIL) for conducting a feasibility study for its proposed Coalnet. It was also developing a materials management system to form part of the total CIL management information system through Coalnet.

## COMPUTERS TO BE INSTALLED ON TRUNK TELEPHONE EXCHANGES

Bombay THE TIMES OF INDIA in English 27 Feb 87 p 16

[Text]

NEW DELHI, February 26: Within less than year of the Sethi episode, the department of telecommunication has discovered how to deal with angry subscribers who turn their ire on the telephone operator.

It is a technological fix that involves installation of computer systems at trunk telephone exchanges. The computer will record the subscribers' requests and priority of calls ignoring the status of the caller.

The computer will dial the call strictly according to priority and first-come first-served basis and the operator will not be able to fiddle with the priority list.

The subscribers will know the status of their calls more precisely through this system which will make paper work redundant. If it still leaves a subscriber dissatisfied, he will have to bang the machine if he gets past the security personnel.

To begin with, eight systems will be installed at trunk exchanges in Guwahati, Agra, Allahabad, Shillong, Patna, Bhubaneswar, Baroda and Ghaziabad.

The CMC Ltd. has been awarded a Rs. 3.6-crore contract for installation of these indigenously developed systems, a prototype of which is being tried at the Flora Fountain trunk exchange in Bombay.

The system in the exchange has terminals at the booking and delay operators' positions as also special consoles for dialling operators.

The new paperless system ensures that a request for trunk call is directly fed into the computer which will automatically switch the booking to the right operator.

The computer will then automatically dial the outstation call as well as the local number. Once the call matures, the computer will calculate the tariff and record it separately for billing.

## TELEGRAPH OFFICES TO HAVE LARGER COMPUTERS

Calcutta THE STATESMAN in English 24 Feb 87 p 14

[Text]

**W**ITHIN five years of their installation, the micro-computers used by telegraph offices in major cities of the country are being replaced by larger computer systems. The first large computer having 128 lines is expected to be installed in Bombay's Central Telegraph Office within the next two months. The Calcutta CTO has also asked for a large computer with 192 lines to improve deteriorating telegram services in the eastern region.

The decision to install micro-computers has been severely criticized during the past few years. It has been pointed out that those who took the decision lacked any idea of the volume of demand all over the country. Critics in the Department of Telecommunications of the Union Government have opined that this was another instance which proved that the "telephone people" who occupied the top-notch positions in the department had no clear understanding of the telegram services and the technology involved in it.

Some senior telecommunications officials feel that micro computers should never have been installed. The Electronics Corporation of India Limited which manufactured these small computers could have produced the larger systems in 1932 itself and all this trouble of replacing one system by another could have been avoided. Incidentally, it is ECIL which is providing the new systems to the Telecommunications Department with some help from foreign experts.

**MISTAKE**

The officials feel the vital mistake is that the small computers being of the "real time" category were not provided with "duplicate

machines". This was not approved by the decision makers and the mistake proved to be costly for the telegraph offices as the computers having no substitutes. Any breakdown resulted in inordinate delays. In fact, the very purpose of installing computers was lost as messages were misheard in transit and customers faced harassment.

The small computers failed to deliver the goods. Official sources point out that they were installed for three purposes. The user wants the despatches to be fast, accurate and neatly presented. Even if the speed of despatch increased to some extent, the accuracy and presentation factors were neglected. The result was that there was almost no relief for the customers.

Officials are, however, optimistic about the larger systems which would enable them to provide terminals to smaller telegraph offices and also to rent quite a few to major users like business houses and newspaper offices to speed up services. For instance, a telegram sent from the Barrackpore telegraph office to the office in Gauhati had results in delays at two CTOs in Calcutta and New Delhi. The new computer will enable both Barrackpore and Guwahati to have terminals connected with the large computers at Calcutta and New Delhi and the stoppages would not be necessary.

**AUTOMATIC**

Telegrams will be sent in "page model" forms as against the "line model" forms used now. The computers are expected to automatically rectify faults if any and would be provided in most cases with duplicate prototypes to avoid delays in the event of breakdown.

In Cuttack, Patna and Guwahati, three large computers each having 64 lines would be installed thereby improving services in the entire eastern region. "Reltron" has been entrusted with the job of providing these 64 line computers required for the three centres in Bihar, Orissa and Assam.

Now that the Posts and Telegraphs Department has been bifurcated, the Telecommunications Department would like to sever all links with post offices, a number of which provide telegram facilities. In Calcutta and its suburbs, there are 78 post offices which offer these services, though perfunctorily, and efforts are on to wind up telegram services in at least 35 of them. For quite some time post office employees have been back adversely handling telegrams and these 78 post offices rarely despatch more than 78 telegrams a day. Instead, the Departmental Telegraph Offices in the city under the direct supervision of the CTO would be strengthened once the new computer is installed and provided with terminals.

Officials in the Calcutta CTO fear that the Centre might "unnecessarily delay" the installation of the larger 192 line computer in the city. They point out that senior officials in New Delhi are arguing that the smaller computers in Calcutta are functioning quite efficiently when compared to their counterparts in other CTOs of the country and therefore, the city may be deprived of a large computer for the time being. CTO officials in Calcutta, however, warn that services would continue to be below standard until the 192 line computer starts functioning in the city.

/9274

CSO: 5550/0100

## BRIEFS

**HIGH POWER RADAR**--New Delhi, 25 Feb--The Minister of State for Science and Technology, Mr K. R. Narayanan, said in the Lok Sabha today that a high-power, coherent, pulse doppler radar operating in very high frequency band and known as the Mesosphere, Stratosphere and Troposphere (MST) radar was being established as a national facility near Tirupati. This radar could be used as a research tool for probing the atmosphere for various studies such as the three dimensional structure of gravity waves and turbulence and tropospheric wind profile. The Minister said this national facility was a multi-department agency funded programme with the Department of Space acting as the nodal agency. The Society for Applied Microwave Electronics Engineering Research of the Department of Electronics has been awarded the contract to design, develop and commission the radar system. This was an indigenous effort and only critical components and sub-systems not available in the country would be imported, he added. The estimated cost and allocation made for this project was Rs 730 lakhs with a foreign exchange content of Rs 155 lakhs. [Text] [Madras THE HINDU in English 26 Feb 87 p 6] /9274

**COMPANY SATELLITE LINK**--New Delhi, 10 Feb--The Steel Authority of India Limited (SAIL) will soon have its captive integrated communication system via satellite, to provide efficient and reliable communication among SAIL plants, mines, central marketing organisations and stockyards. An agreement to prepare the detailed project report was signed here recently between the centre for engineering and technology (CET) of SAIL and the consortium of GNC Ltd., New Delhi and Indus Corporation Inc., U.S. The detailed project report is expected to be ready by the end of June. The project is to be implemented in a phased manner. It is hoped that it will be commissioned by the end of 1989. The entire project is being co-ordinated by CET. The use of a satellite for management purposes is yet another measure by SAIL to use modern technology in its plants and units. The data error rate of the satellite network will be less than one in ten million and the downtime less than 10 hours in a year. The response time will be less than three seconds. The primary network control centre will be located in New Delhi. Provisions will be made for installing a standby centre at Calcutta or Ranchi. Optimal use will also be made of the DOT's existing earth stations. [Text] [Bombay THE TIMES OF INDIA in English 11 Feb 87 p 14] /9274

CSO: 5550/0103



## BRIEFS

RADIO EQUIPMENT DEAL SIGNED WITH CANADA--Zimbabwe and Canada have signed a 2.5 million dollar contract for the supply of radio equipment. The equipment will be used to improve telecommunications networks in Kariba, Chimanimani, Cashel Valley, and (Mkwasini). The contract is funded by the Canadian Industrial Development Agency. [Text] [Harare Domestic Service in English 1115 GMT 6 Mar 87] /9599

ZBC PLANS FM FREQUENCY CHANGES--The Zimbabwe Broadcasting Corp. would like to inform all listeners that between now and July 1987 there will be changes to frequencies on all FM transmission throughout the country in order to conform to new international regulations agreed upon at a conference held in Geneva in 1984. These changes will spread over a period of 7 months with minimum interference or inconvenience to listeners. All radio stations will keep listeners informed of the changes as they occur. It should be noted that these changes will not affect medium wave and shortwave transmissions. [Text] [Harare Domestic Service in English 0500 GMT 7 Mar 87] /9599

CSO: 5500/41



## TELECOMMUNICATIONS AGREEMENT SIGNED WITH DRA

LD101152 Moscow TASS in English 1133 GMT 10 Mar 87

[Text] Moscow March 10 TASS — High-capacity relay centres which the USSR will supply to Afghanistan over the next few years will make it possible to introduce television in all the provincial centres of the republic. A contract on the supplies of T.V. technology was signed during the visit of Soviet Communications Minister Vasily Shamshin to Afghanistan.

Vasily Shamshin told TASS that the USSR was providing technological assistance to Afghanistan in the development of a radio relay system, thanks to which telephone links have been established between Kabul and 15 provinces. A ground centre of a space communication system built by Soviet specialists in Kabul provides Afghanistan with telephone and telegraph links with other countries. The centre is used also to exchange TV programs through the intervision system and to beam out programs of Afghan central television to seven provinces of the country.

Soviet-made sound amplifiers and street loudspeaker systems are in operation in many Afghan towns and communities.

Guidelines for further cooperation were laid in talks with officials of the Afghan Communications Ministry, Vasily Shamshin said. Before 1990, the Soviet Union will supply diverse communication equipment to Afghanistan to bring radio broadcasting to the entire territory of the country.

/12858

CSO: 5500/1024

'MAILBAG' GIVES RATIONALE FOR JAMMING BROADCASTS

LD142338 Moscow in English to Great Britain and Ireland 2000 GMT 14 Mar 87

[From the "Moscow Mailbag" program, presented by Gennadiy Nikiforov and Aleksey Stroganov]

[Excerpt] [Passage omitted] [Nikiforov] William Cassidy in Rainhill, Merseyside, wants to know about the jamming of radio stations.

[Stroganov] You may be interested to know that, contrary to the popular belief in the West, it was not the USSR that introduced jamming first. Austria was the first state to use it, back in 1938 when the Austrian Government decided to jam Nazi broadcasts, which was in line with an international convention adopted 9 years earlier, for the convention banned radio propaganda aimed at undermining a sovereign state's political system. And that was the aim of Nazi external broadcasting before and during the war. The 1936 convention provided for radio being used in the interests of peace and international security.

In the early seventies another international convention legally established the right of any state to interfere with broadcasting that undermines national security and offends people's feelings. The adoption of this particular convention was a necessity in view of what has been going on in international broadcasting in the last several decades, during which the West started a real psychological war in the air with the prime target being the USSR and other socialist countries. Suffice it to recall the role played by Western broadcasting in provoking the events in Poland back in the seventies. Quite a few of such stations are in fact fronts for intelligence services, notably the CIA, which runs such stations as Radio Free Europe.

The Soviet Union, in accordance with the international convention on broadcasting, has been jamming those radio broadcasts that are aimed at undermining national security, spreading anti-Sovietism, ethnic antagonisms among our people, and broadcasts that may be considered war propaganda or that offend our people's dignity. Recently, as a sign of good will, we stopped jamming the Russian service of the BBC. We did so in the firm belief that international broadcasting should serve the cause of better understanding and peace, and not the cause of mistrust, suspicion and hate.

/12858

CSO: 5500/1024

## BRIEFS

FRG TV-RADIO PROTOCOL--Bonn, 12 Feb (TASS)--A working protocol on cooperation for 1987 between the USSR state television and radio and the West German television and radio "Westdeutscher Rundfunk" has been signed in Cologne. The document envisages exchanges of television materials on some of the most important events in the life of the USSR and the FRG, including the preparations in the Soviet Union for the celebrations of the 70th anniversary of the Great October Socialist Revolution and the 65th anniversary of formation of the USSR. Both sides have agreed to help each other in the preparation of broadcasts about culture, science, and the art of the two countries. The signing coincides with the 10th anniversary of cooperation between the USSR state television and radio and "Westdeutscher Rundfunk." [Text] [Moscow TASS International Service in Russian 0710 GMT 12 Feb 87 LD] /6091

LENINGRAD, EAST EUROPE COMMUNICATIONS--Leningrad, 7 Feb (TASS)--As of today, automatic telephone communication has been established between Leningrad and a further six cities in the European socialist countries. Leningraders now have high-speed links with over 100 cities of Bulgaria, Hungary, the GDR, Poland, Czechoslovakia and Yugoslavia. [Text] [Moscow TASS International Service in Russian 1043 GMT 7 Feb 87 LD] /6091

CSO: 5500/1023

# ITALIAN BRANCH OF 'EARN' RESEARCH DATABASE NETWORK PLANNED

Turin MEDIA DUEMILA in Italian No 1, Jan 87 pp 20-25

[Article by Stefano Trumpy, director of the Cnuce Institute of the National Research Council (CNR): "The Importance of Being Called EARN;" first paragraph is MEDIA DUEMILA introduction]

[Excerpts] "EARN" stands for European Academic Research Network, a European computer network similar to the American organization BITNET with which it is connected. EARN provides the facility of an easier exchange of information between universities and research institutes. Twenty countries are involved, with 300 nodes, 35 of which are located in Italy. The services provided include file transfer, remote job entry, and electronic mail facilities. The present situation and future prospects.

The first conference for users of EARN was held in Berlin at the end of October last year.

A number of authoritative speakers emphasized the importance of scientific and technological research for economic growth and the survival of Europe. Cooperation between nations and the exchange of scientific knowledge are obviously key elements for this. It is widely known that telecommunications are essential to Europe if it is to remain competitive in advanced technology. It is also evident that the resources now available to this sector in universities and government research agencies are inadequate.

EARN has already given concrete results which prove that this situation can be improved.

Various aspects, opportunities, and difficulties concerning telecommunications networks confronting the scientific community were discussed and highlighted, and the prospects for the next 5 years were reviewed. Instead of reporting the meeting in chronological order, I would like to describe the network's present situation and its future prospects, updating this description with the results obtained from the conference.

## A Brief History of EARN

EARN is a widely diffused international computer network, which is based on the use of IBM's NJE protocol. The NJE (Network Job Entry) protocol was

originally developed to provide remote job entry to computers. The system in fact makes it possible to send files via any number of intermediary computers through to their destinations guaranteeing such services as file transfer, remote job entry and electronic mail.

Today, all the members of the European Common Market are involved in this network, as well as Austria, Finland, Iceland, Israel, Norway, Sweden, Switzerland, and Turkey. Soon the Ivory Coast will be included and the total number of countries involved will amount to 20. The total number of nodes in EARN now amounts to approximately 300; the largest community is that of the FRG, which totals 140 nodes.

Different European countries have had different approaches to EARN. Britain, which already had a national university network called JANET, decided to develop its own gateway to EARN, thereby constituting a single node within the system.

At first Italy connected its CINECA system to EARN, then CASATA and then RPCNET, the entire scientific computer center network of the CNR [National Research Council]. From the beginning, this network was in fact fully compatible with EARN, since it used the same protocols. Therefore, it was convenient to include all six nodes, making each one accessible to the other nodes in the EARN network.

The Italian nodes now total 35 and are [constantly] increasing. Many university computer systems have been included, together with university consortiums, and several INFN [National Institute of Nuclear Physics] departments.

In fact EARN and BITNET are one single network since there is a single control of addresses, and the protocols used and the services offered are the same. Of course, for the Americans EARN is a European extension of BITNET, while for us BITNET is the American extension of EARN. It must be acknowledged that, since it was created earlier, BITNET has a better established and larger organization and a much greater number of nodes. An interesting confirmation of this is shown by the fact that at this moment the Europe-United States connection is paid for entirely by Europe, almost as if the interest in the intercontinental connection were one-sided. This is not the case, and the Americans themselves recognize this. Since IBM support expires at the end of 1987, discussions on cost-sharing of the intercontinental lines will intensify and EARN will surely demand total equality with BITNET.

#### The Situation Today

#### How It Works

Each country's principal node (the principal node in Italy since December 1986

has been Cnuce of Pisa) controls the "virtual machine" NETSERV, which supplies the user with the procedure for network management and with information on the network services. Each computer within the network must contain traffic control tables to control the information paths. It is obvious that these tables must be consistent throughout the whole network.

As far as the commands are concerned, these are based on standard CMS [Computer Management System] system commands, a system widely in use today for IBM or IBM-compatible computers, and on the EXEC procedures which are simply a pile of CMS commands carried out in sequence. This approach is based on the use of standard commands of one of the most widely used operating systems and ensures that the new services provided by the EXEC procedures are easily carried on the network's nodes, making use of these services much more immediate for the newcomer.

#### Connection with Non-IBM Systems

Since IBM-compatible computers primarily use IBM operating systems, it follows that connecting these computers with EARN creates the same problems as connection with an IBM computer. And what about the others? It is important to state immediately that approximately 40 percent of the computers connected to BITNET and EARN are not IBM. Some are IBM-compatible, but the majority are "different" computers.

The market share for IBM machines plus IBM-compatible machines today amounts to 70 percent of the total for high-to medium-power computers. This has led to a situation where, at least as far as remote job entry is concerned, the NJE in practice has constituted a de facto standard accepted by other producers of hardware who are interested in having their computers communicate with the majority of other computers available on the market.

For this reason, there has been a rush of "protocol emulators." That is, software programs which allow a DEC, Sperry, CDC computer, and others to enter the world of IBM in the same way as any other IBM computer. Therefore, through the use of these emulators which were already in wide use before the formation of BITNET and EARN, it is possible to connect the majority of computers distributed today throughout the market to these networks.

This is the first important step which establishes EARN as a network independent of computer manufacturers.

However, there remains a fundamental drawback. The protocols used by EARN are not standard, since they were created over 10 years ago. This gives rise to the following problem:

#### Migration to Standard ISO/OSI architecture



Responsibility for the definition of standards has been entrusted to various international organizations. I will not list these here, as it would only further distract the reader's attention which, I suppose, already is wavering. The most influential organization is the ISO (International Organization for Standardization) which has defined the OSI architecture (Open System Interconnection) for computer interconnections.

The ISO/OSI architecture is based on the well-known seven levels. The first five are well defined, while the last two, which are dedicated to the control of compatibility for user applications, still are at the proposal stage.

The most important and sensitive computer manufacturers have understood the importance of the ISO/OSI architecture, and have foreseen the aggressive intentions of the European Community who have threatened several times to exclude non-compatible computers from offers for bids. As a consequence, IBM also has recently opted for OSI, though in association with its own network, SNA (Systems Network Architecture), an association which has not been clearly defined yet.

Therefore, for the EARN community the migration to OSI is a strategic move to attract the attention of the European Community and EUREKA, and to give the go-ahead to a scientific research network which is effectively open to all manufacturers.

In 1981, the CNR in Italy launched the OSIRIDE project via the Cnuce for the establishment of an international network which conforms to the ISO/OSI standards. This project is currently under development with the participation of the most important manufacturers.

#### Use of Public Networks

In most European countries, including Italy, the use of rented lines is not considered as conforming with the regulations of the postal services, and authorization for use of these lines has been granted to EARN only provisionally. This is because the network nodes carry out a traffic control function toward other nodes and because the PTT's refusal to consider the various university and research institutions as a single body requiring a high level of internal data exchange for noncommercial reasons.

In short, the PTT's want EARN to agree to pay a time rate or traffic volume rate on the lines currently rented. If, as has been suggested in several cases, a volume rate were adopted which was the same as that for the X25 package switching service, the present cost for data transmission would be increased by a factor of five or more.

This proposal gives rise to at least three serious disadvantages. The first and most obvious one is the undesirable increase in costs, even more serious

if we consider that the present cost of international lines in Europe are five or ten times higher than the corresponding lines of the same length in the United States.

The second disadvantage concerns the loss of the ability to forecast the network's costs. This forecasting capability is essential to state institutions.

The third one is represented by the necessity to install traffic count devices capable of calculating the cost of even a single file transmission made by the user. In other words, it is necessary to be able to calculate a genuine stamp whose value is proportionate to the quantity of data sent or received for every file transmitted. The Italian PTT and the PTTs of other countries have put forward the suggestion that data received also should be paid for to avoid the complicated recrediting procedures applied to normal mail. This alternative could cause difficulties because some countries would charge by traffic volume while others would apply a standing charge. The mailing of data sent free-of-charge by users in countries applying a standing charge would only be paid by the recipient, and this would cause problems which could threaten the present network organization.

At the European level there is a central committee for the coordination of the PTT, called CEPT [European Conference on Postal and Telecommunications Administration], which has asked the various national PTT's to apply a standard charge system for EARN throughout the continent. It should be noted that the CEPT is an advisory body and may only make recommendations, whereas the national PTT's are independent in their decisionmaking.

At the present time, the Board of Directors of EARN are working with the CEPT, and the [individual] country managers are in contact with their respective PTT's. The situation is still extremely fluid and lacking in uniformity. There remains the fundamental problem that scientific research in Europe could be at a great disadvantage with respect to the United States and Japan. This obviously should be avoided at all costs.

It is worth quoting word-for-word the resolution adopted at the last roundtable conference of the members: "The members of the EARN association should coordinate their efforts in order to obtain data communication services at reasonable costs from their postal organizations and international communications agencies in order to encourage their use within the university research community and government research agencies."

#### Management Structure

EARN is managed by a Board of Directors, that is, national representatives who are chosen from each country by the representatives of the nodes.



An Executive Board controls EARN's operations and meets more often. It is currently made up of a president and vice president as well as the country managers of Germany, France, Italy, the United Kingdom, and Sweden.

At the Board of Directors' meeting held after the conference the following officials were elected for the 2-year term 1987-1988: Dennis Tennings - Ireland, president; David Lord - CERN, vice-president; Michel Hebgen - the FRG, secretary general; J. Claude Ippolito - France, treasurer. Other members of the former Board of Directors have been assigned the following responsibilities: Paul Briant - United Kingdom, technical groups coordinator; Brigitta Carlson - Sweden, new members committee; Stefano Trumpy - Italy, CEPT relations.

EARN was set up as a nonprofit organization under French law in Paris in February 1985.

Any new node wishing to join should get in touch with the appropriate national coordinator and sign a standard conduct form. The entry of new countries must be proposed to the president and discussed by the Board of Directors.

In the last Board of Directors' meeting, application for entrance by the Ivory Coast was accepted, and South Africa's application was refused.

#### Technical Coordination

Considerable human resources and equipment are dedicated to management of the EARN network, since today these are made available free-of-charge by the members and generally will continue to be free in the future. Below we give a list of activities in which the agency's technical personnel are involved:

- Control of NETSERV, (the "virtual machine") which supplies the documentation relating to management of the network.
- Preparation of the documentation to be inserted in the network.
- Traffic statistics and measurements.
- Testing of new services.
- Migration to ISO/OSI.

#### Looking to the Future

##### Transfer of the European Node EARNET to CNUCE

When EARN was first formed, the European Coordination Center as well as the central connecting point of all the international lines were established by IBM at its Scientific Research Center in Rome.

As IBM will soon be withdrawing its support, IBM Italy has made the proposal to the CNR to transfer the EARNET node to CNUCE in Pisa.

The CNR is already involved in a series of initiatives regarding networks, and has gladly accepted the proposal. The transfer will take place by the end of 1986.

#### Actions Connected with the Withdrawal of IBM Support

Taking for granted that the organizations with the greatest involvement will continue to give their support in terms of personnel for management of the network, it will be necessary to find financial resources to cover the remaining costs, which primarily consist of telecommunication charges.

The network's present configuration is not the most rational and in some areas is even redundant. By the end of next year the structure of the network of intercontinental lines could be fundamentally revised.

It has been suggested, for example, to install a European/North American communications line via satellite which could replace one or both of the present communications lines (Pisa--New York and Darmstadt--Washington), and to set up a communications network within Europe in which each country would be fully responsible for a single international communications line, (present cost approximately 90 million lire per year).

For this last proposal, the cost for each country would consist of the cost of the international line plus the appropriate share in the cost of a management infrastructure which has not yet been defined but which will be kept at a minimum.

In other words, the most important task now is to make it possible for the network to survive the termination of IBM support, a task in which the Board of Directors is fully involved.

The cost charged to each country may then be sustained by one or two central organizations such as the CNR or INFN [National Institute of Nuclear Physics], or channeled to the computer centers which make up the network nodes, or even charged to the final user. This last proposal seems a remote possibility at the moment and certainly depends on the adoption of traffic volume charges, an undesirable measure. In the second proposal the annual charge per node should not exceed 5 or 6 million lire while the annual total for Italy should not exceed 200 million.

#### Connection With the OSIRIDE Project

Since Cnuce has put forward the proposal and is the principal director of the OSIRIDE project within the CNR, it is obvious that every effort will be made to direct migration of EARN to the OSI in the best way possible and in coordination with other European countries. The presence of OSI experts in Cnuce undoubtedly places Italy at an advantage regarding EARN's migration

toward standard architectures.

#### Connection with European Projects

There are other projects similar to OSIRIDE in other European countries, for example the DFN project in the FRG.

A user association has recently been formed called RARE [Associated Networks for European Research]. Its objective is to coordinate European efforts in the creation of university networks for scientific research, with specific reference to the definition of functional standards conforming to the recommendations of the international standards agencies. All the member countries of EARN, with one or two exceptions, are members.

Within the framework of the EUREKA project a feasibility study for the COSINE network (Cooperation for OSI in Europe) has recently been approved. The feasibility study has been entrusted to RARE, which will complete the study in approximately 1 year.

Since the COSINE network should eventually constitute the European network for both public and private research, it is obvious that EARN has a great interest in these developments, especially when one considers that the greater part of the services requested for the COSINE network are at present supplied by EARN. For this reason, EARN has requested and obtained the position of international partner of RARE. Furthermore, it has established relationships with the European Community which has recently taken the initiative of coordinating the development activities of the scientific research networks.

#### EARN's Geographical Extension

There are many requests for access to the EARN BITNET network. Many, such as those from developing countries do not create any problems, while others are more difficult to deal with, such as those from South Africa and the Communist bloc countries.

In an ideal situation, the university and scientific research world would have an instinctive tendency not to impose any type of obstacle. On the other hand, considerations of international politics are important, especially if they are even marginally involved with governments or government institutions such as the PTT's. Practical considerations of economic protectionism regarding exports to the United States require a certain caution.

For this reason, the Board of Directors has [at the moment] refused access to South Africa and postponed any decision regarding several Eastern European countries, but has accepted the Ivory Coast's application without any problem.

The conference had a considerable success from the point of view of the number

of people present (approximately 350 delegates, 27 of whom were Italian) who actively took part in the roundtables with comments and suggestions. Furthermore, the Board of Directors, after the exhausting work of organization of the EARN '86 Conference, had originally planned on a second conference in 2 years, but because of the success of EARN '86, this is now scheduled for the end of next year.

Transmission technique used is that of the subsystems RSCS/VM and JES2/MVS



#### Services Offered

1. File Transfer
2. Job entry and implementation
3. Message transmission
4. Communications with Western Europe, the Middle East, the USA (BITNET), Canada, Japan, Asia, Australia
5. Access via gateways and other networks such as ARPA, CSNET, etc.

1. CNR
2. Universities
3. Other research agencies

#### Members present at the EARN conference:

Communications in Europe: K. Zander, DFN president.

European Cooperation in Space: H. Curien, former director of the European Space Agency.

Scientific Cooperation in Europe: H. Schopper, director of CERN.

The Telecommunications Environment Present and Future: L. Pouzin, CNET, Paris.

EARN's Successes and Challenges: D. Lord, president of EARN.

Communications between the University Networks in Europe: P. Linington, president of RARE.

Telecommunications: The Future of Technology: B. Catania, Director General of CSELT.

Evolution in University Networks in the USA: L. Landweber, University of Wisconsin.

The BITNET Network: I. Fuchs, University of Princeton.

User Expectations from the Telecommunications Services in Europe: R. Nordhagen.

The Round Table: The User's Point of View. Moderator D. Jennings, University of Dublin.

ITV and Education in Europe: G. Hubbard, University of London.

University Networks in Japan: J. Osada, University of Tokyo.

World-Wide University Networks: H. Budd, Director of Scientific Research, IBM Europe.

#### Italian Nodes in EARN

IBACSATA

CSATA - Valenzano (Bari)

IBO4341

CINECA - Casalecchio di Reno (Bologna)

ICINECA

CINECA - Casalecchio di Reno (Bolzano)

ICINECA1

CINECA - Casalecchio di Reno (Bolzano)

ICINECA2

CINECA - Casalecchio di Reno (Bolzano)

ICNUCEVM

CNR - CNUCE - Pisa

ICNUCEVS

CNR - CNUCE - Pisa

ICSATA

CSATA - Valenzano (Bari)

ICSCRAI

CRAI - Rende (Cosenza)

ICSUNIV

University of Calabria

IECSEC

IBM Scientific Center - Rome

IFIIDG

CNR - Institute for Legal Documents - Florence

IFICHIM

University of Florence

IGEICE

CNR - Institute of Electronic Circuits - Genoa

IMIBOCCO

"L. Bocconi" University - Milan

INICLVX

CILEA - Segrate (Milan)

INISIAM

CNR - Institute for Cosmic Physics - Milan

INIPOLI

The Polytechnic of Milan



IPACUC  
 University of Palermo

IPDUNIV  
 University of Padoa

IPGCUIC  
 Italian University for Foreign Students - Perugia

IPGUNIV  
 University of Perugia

IPIINFN  
 INFN - San Piero a Grado (Pisa)

IPISNSIB  
 Technical School - Pisa

IPISNSVA  
 Technical School - Pisa

IPIVAXIN  
 INFN - San Piero a Grado (Pisa)

IPRUNIV  
 University of Parma

IPVIAN  
 CNR - Institute of Numerical Analysis - Pavia

IRMCNR  
 CNR - Computer Center - Rome

IRMCRA  
 Aerospace Research Center - Rome

IRMEMU  
 INFN - Emulator Farm Development Center - Rome

IRMLUISS  
 University for Social Studies - Rome

IRMIAS  
 CNR - Institute of [Spacial] Astrophysics - Frascati, (Rome)

IRMUNISA  
 "La Sapienza" University - Rome

IRM2CIV  
University of Rome 2

ITOC SIP  
Consortium for Information Systems - Turin

ITOIMGC  
CNR - The "G. Colonetti" Institute of Meteorology, Turin

ITOPOLI  
The Polytechnic of Turin

8618  
CSO: 5500/M163

## TELETTRA RESEARCHERS DESCRIBE GaAs MESFET CAD DESIGN DEVELOPMENTS

Milan RIVISTA TELETTRA in Italian No 3, Dec 86 pp 17-32

[Article by G. Marzocchi and G.F. Piacentini of Telettra SpA, Vimercate, Italy: "Gallium Arsenide: Technology and Applications;" first five paragraphs are RIVISTA TELETTRA introduction]

[Excerpts] Progress made in recent years to improve the characteristics and performance of transmission equipment would not have been possible without constant and continuous integration between new developments in technologies and systems and the use of gallium arsenide (GaAs) technology. The growing demand for circuits capable of operating at increasingly high frequencies and speeds or with transmission capacities in higher basebands significantly promotes GaAs technology. This technology lends itself to the development of new integrated functions at frequencies higher than the gigahertz and to optical integration of lasers and driver circuits.

This study describes some original developments achieved by Telettra both with regard to the technological production processes of GaAs devices and the corresponding design techniques, and with regard to the systems applications produced.

Beginning with problems concerning the quality of the material, the results and performance of power devices in the X band obtained with epitaxy or ion implantation techniques are analyzed and compared.

In addition to the various phases of the production process, the sequences in the design of individual devices and analog integrated circuits using two-dimensional models of metal semiconductor field-effect transistors (MESFET), and CAD procedures developed at Telettra are discussed. Finally, some new developments in the "container" sector are presented. These containers, thanks to the specifications adopted, solve the problem of false resonance (up to frequencies of 21 gigahertz) and problems of thermal resistance and associated dilatation.

The impact of these devices on the reliability and cost of high-capacity radio links in optical fiber transmission systems (at 34, 140, 565 megabits/second and at 2.4 bits/second) is analyzed. In conclusion, the specific characteristics required of the devices used in microwave amplifiers and oscillators, as well as in optical transmitter and receiver modules for long-

distance systems are evaluated.

#### Device Modeling and Design

Figure 14 shows the cross-section of a MESFET device.

The transistor works as a triode in which the electrons emitted by the source (S) are modulated by applying a negative voltage at the Schottky junction of the gate (G). When the voltage is high enough to make the region of the depletion zone under the channel reach the buffer layer, no electrons can pass, and the channel is said to be cut off.

Examples of low-signal devices have been available since the second half of the 1970s, but these have proved to be of limited use both in very high frequency applications and for power devices.

Computer aided design (CAD) is today an indispensable method for the fast development of prototypes. However, the tools necessary for CAD adapted to microwave monolithic integrated circuits (MMIC), such as the definition and modeling of components and numerical design techniques, cannot be based on highly theoretical devices, as often happens in some CAD programs available commercially. Rather, they must take into account the extent to which these can be processed and reproduced. For this reason, Telettra is turning its attention to the development of software packages adapted to MMIC CAD.

CAD analysis of active components (such as MESFET, coils, and capacitors) suitable for integration, involves two types of problems: on the one hand, the need for slim, fast models which subsequently can be incorporated into a more general CAD program, and on the other hand the need for a more complete and sophisticated program to assist design of individual devices.

Consequently, it is necessary to divide the problem into two parts and to build two CAD simulators, one for the circuit designer and one for the technology expert.

A two-dimensional model of a MESFET has been produced. It is capable of estimating accurately the effect of the shape, the characteristics of the material, and the doping profile on electrical performance (I-V curve, behavior in frequency, and noise factor). It is also capable of estimating those parameters that are not visible (internal distribution of the electric field and of charge carriers, high-field and breakdown regions). (Figure 16)

The usefulness of such a program is evident. It allows the technology expert to explore the effect of new forms, doping profiles, and structures without having to resort to expensive and lengthy prototype testing. The model, developed by the Turin Polytechnic on behalf of Telettra, uses Gummel's interactive method to solve Poisson's continuity equations, and can provide

both the static (direct current) and dynamic behavior of the device at low signals. An example of the power of the model is given in Figures 17 and 18 which show the effect of small variations (in the doping profile) on the I-V characteristics of the device.

The efforts being made both in modeling and in simulation have led, over a very short period, to the design of a family of medium-high level MESFET devices in the X band, with an output power of 100 milliwatts, 1 watt, and 1.7 watts.

These devices, which use gates (G) with a length of 0.8 micrometer and air-insulated bridges to connect the multiple zones of the source (S), have the typical DC and RF (direct current and radio frequency) characteristics shown in Table 4.

Also, the technology of air-insulated bridges has led to a new approach to the structure of these devices, employing air-insulated electrolytic bridges to increase greatly the size of gate connections.

The process, patented by Telettra, makes it possible, by lateral extension of the gate strip, to construct devices with a different structure. This reduces dramatically the parasitic resistance (distributed along the gate metallization), one of the major limitations of submicrometric devices for very high frequencies.

The result is improved by gain and noise behavior compared to traditional structures. Figure 23 gives a comparison of the two structures. It shows that for a conventional MESFET device with a 1 micrometer gate, the noise figure at 10 GHz is between 1.85 and 1.95 decibels, while with a gate bridge device, a reduction of 0.4 decibels was recorded at the same frequency.

The proposed structure should make it possible to achieve very low noise figures and high frequency/power products without having to resort to submicron sizes, thus avoiding severe reductions in the production yield.

In the field of analog integrated circuits, efforts have been concentrated on the development of a library of [characterized] active and passive elements up to 18 gigahertz. This work, carried out within the context of the EEC's ESPRIT program, covers the following research fields:

- distributed passive elements with concentrated constants (L,C,R, high- and low-impedance lines, couplers, discontinuity, etc...);
- models of single or dual gate MESFET equivalent circuits;
- MESFET two-dimensional physical model;
- groups of passive elements and reciprocal interaction.

The first step was to produce a monolithic amplifier with an intermediate frequency of 1 gigahertz using ion implantation. The first prototypes were

made using, as an intermediate phase, an epitaxial layer insulated through oxygen implantation.

### System Applications

Telettra has been active in the design and production of radio links since 1949. In 1974 the company began to use MESFET devices in radio-frequency circuits as a natural development of traveling-wave tubes and silicon bipolar transistors.

The key stages in the introduction of GaAs devices in radio transceivers were the following:

- the large-scale application in 1976 of GaAs MESFET devices in low-noise (2-11 GHz) RF amplifiers;
- the application of medium-power GaAs FET in local microwave oscillators operating between 6 and 15 GHz (up to now, more than 5,000 stabilized cavity oscillators have been produced using GaAs FET);
- the design and production of power amplifiers (up to now, more than 1,000 units of 2-Watt amplifying systems at 4 QAM and 1,500 units at 16 QAM have been produced).

In optical fibers, GaAs FETs have been used (at low noise) in the preamplifier stages of PINFET modules for systems at 140 megabits/second.

### Local Oscillators

One of the most critical problems in the application of GaAs FET devices in local oscillators is the MESFET noise level (which is much higher than in bipolar transistors) near the carrier frequency.

The main sources of this background noise in the devices are:

In the device structure:

Bulk defects:

- in the neutral region of the channel
- in the depletion region
- at deep levels;

Interface effects:

- between the semiconductor and air
- between the semiconductor and passivation
- between the active layer and the buffer.

In operating :       ons using direct current supply:

Breakdowns occur:

--between the gate/drain junctions at maximum signal levels.

It might be useful to note that bulk defects primarily are correlated with ion/carrier interactions, and that interface effects are less important in bipolar devices.

In order to reduce the noise level caused by gate-drain breakdown, the voltage of the source must be maintained at a much lower level than the typical values used in microwave amplifiers.

#### Linear Power Amplifiers

As the non-linear transfer characteristic of the amplifiers has a direct effect on the bit error ratio (BER) of the devices, the following factors must be carefully controlled:

- behavior of the GaAs FET used in the amplifying system (the power stage is the most critical);
- techniques used to improve linearity (predistortion and automatic level control (CAL));
- the technology and circuit adopted and the type of substrate (thin film or thick film, quartz or alumina).

The transfer characteristics of the high-power MESFET must be as sharp as possible in the transition from linear to saturated conditions. The predistortion circuit must equalize both the amplitude and phase characteristics, in order to reduce the BER  $10^{-3}$  threshold from 4 decibels to 0.2 decibels without a predistortion circuit.

MESFET devices used in linear power amplifiers must have the following characteristics:

- a suitable carrier concentration profile which makes it possible to linearize the transconductance (GM) characteristics toward voltage gate polarization (VGS);
- a breakdown voltage high enough to be able to operate with a higher voltage/current value;
- a low thermal resistance and a high conversion efficiency, in order to operate with reduced channel temperature values to avoid degradation of the characteristics of the device under operating conditions.

#### Micromodules for Amplifying Systems

Recently, thanks to the [availability of the] GaAs FET production process at Telettra, a new approach to the production of microwave amplifiers has been introduced.

This new production philosophy is based on the introduction of amplification stages in miniature, hermetically sealed containers, which make it possible to



produce amplifiers using the approach typically used for electronic components facilities.

These "amplifying micromodules" are used for the production of medium-high power amplifiers at frequencies between 2 and 23 GHz.

The major characteristics of the micromodules are:

- a saturated output power of 1 watt at 8 GHz and 200 milliwatts at 23 GHz;
- pre-calibration at standard loads;
- thin film technology with GaAs FET devices in chips;
- autopolarization circuits at up to 8 GHz inside the containers;
- connection with the external circuit through terminals welded using traditional techniques.

The advantages of the procedure adopted are the following:

- greater compactness;
- greater operating band amplitude
- a production process which can be automated easily;
- lower sensitivity to electromagnetic compatibility (EMC) disturbance;
- easier system maintenance.

#### Applications in Optical Fiber Transmission Systems

In optical fiber systems, the use of GaAs devices is determined by the special characteristics of high-speed long-distance systems.

The need to reduce interfering inductance and capacitance in low-noise transmitters and receivers for high-speed systems involves the design of highly-integrated optoelectronic modules using the technology of thin or thick films and of MESFET devices in chips placed as close as possible to the optoelectronic devices (lasers, PIN, APD).

For this reason, a complete series of optoelectronic receiver modules of the PIN-FET or APD-FET type, ranging from 2 megabits/second up to 565 megabits/second, has been developed. For this purpose, systems using transimpedance as well as high impedance were used. Table 6 shows the typical behavior of the APD-FET receiver at 565 megabits/second.

For very high-speed systems (2.4 gigabits/second) a transmitter module which integrates the laser source with the associated driver stage has been produced using a container (designed by Telettra) which satisfies the mechanical, thermal, and optical stability requirements. (Figure 29)

#### Future Developments and Applications

Although GaAs technology still is in the early stages, new developments in the devices and associated processes are already underway.

Examples of these are:

- low-noise devices will move from MESFET structures to high electron mobility transistor (HEMT) structures, primarily because of the greater low noise requirements of amplifiers at frequencies higher than 20 GHz;
- high-power MESFET will move toward bipolar solutions with heterojunctions or new structures (such as the structure with the air-insulated bridge on the gate, patented by Telettra), increasing output power by more than 5 watts between 30 and 40 GHz.

This progress will also be characterized by system developments such as:

- a further increase in the M-QAM modulation system levels to obtain an operating efficiency of the spectrum higher than 5 bit/Hz;
- an increase in operating frequencies using millimetric waves, especially for data transmission applications;
- the use of wavelengths greater than 1.3 micrometers in long-distance optical fiber transmission systems;
- an increase of baseband capacity above 2.4 gigabits/second;
- the use of coherent modulation methods to increase receiver sensitivity.

The effects of an increase in the use of GaAs devices in radio link systems are shown in Table 7. This table also shows the growing importance of these devices for the entire system cost.

#### Reliability Features

Techniques which guarantee the reliability of new technologies must be studied in detail, both to guarantee the reliability levels required for applications and to define appropriate correlations between catastrophic breakdowns and parameter drifting.

Checking the reliability value of the devices is fundamental when one considers that these devices will have a direct bearing on systems, such as high-capacity numerical radio links or long-distance optical-fiber transmission systems, which can carry up to 10,000 conversations simultaneously.

Because of the problems involved in stressing the devices without causing catastrophic burnouts, testing with DC [direct current] sources only is preferable to RF [radio frequency] life tests.

The experience acquired at Telettra suggests that RF testing induces the same breakdown mechanisms produced with DC testing. However, the advantage of DC testing is that it permits greater control of operating conditions and monitoring of the most significant parameters.

From the results obtained over recent years with these devices (including those using different technologies), it is possible to establish that the most

important DC tests are the following:

- high-temperature strain aging (HTS);
- DC operational life at high temperature (HTOT);
- high-temperature test with gate reverse current (HTRB);
- high-temperature test with high DC at gate (HFGC).

Control of the gradual degradation of the parameters is guaranteed by careful stabilization of polarization to minimize the power available for burnout.

With respect to reliability, the tests performed and analyses of breakdowns have shown that the critical areas are the following:

- the state of the surfaces between the gate and the source or drain;
- the ohmic contact of the source and drain;
- the Schottky contact of the gate and the region around the channel;
- gate metallization.

Data gathered from tests performed on commercial devices and devices produced by Telettra made it possible to establish an evaluation procedure for device reliability (Table 8), which also is based on specific studies of possible breakdown mechanisms:

- HTOT with D.C. polarization. This is a test which identifies the phenomena sensitive to the combined effects of temperature and electric field;
- HTRB is a specific test to verify surface effects and resistance to breakdown;
- HFGC is a test which speeds up electromigration phenomena.

Figure 30 [not shown] shows the testing equipment designed at Telettra for HTOT tests, while Figure 31 compares [results of] the stability of various devices with Au-or Al-based metallizations.

A complete physical model of the degradation mechanisms has not been developed yet. However, from the tests performed, it has been possible to develop empirical correlation laws, to describe the behavior of devices under various types of stress.

## Conclusions

Work begun several years ago to develop GaAs technology for telecommunications applications from the laboratory stage to industrial production have made it possible to successfully launch production with an adequate level of automation, good production levels, and a process that can be repeated on a good number of medium-high power level X band devices and integrated circuits.

The technology available and behavior control have made it possible to develop a series of applications (for both radio and fiber optic systems) which have

significantly increased the use of gallium arsenide.

The predominance of physical models using two-dimensional simulation and a complete series of reliability tests and research into breakdown mechanisms means that we can confront the problem of the reliability of the devices and the systems, using them with confidence.

From the experience acquired from tests run on devices produced by Telettra or available on the market, models of breakdown mechanisms and empiric correlation laws between stress and degradation have been developed for:

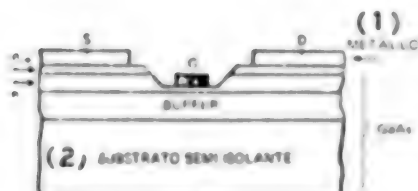
- the degradation of the surface between the gate and the source or drain;
- the degradation of ohmic contacts;
- the degradation of the Schottky junction;
- the electromigration of the gate metallization.

However, to guarantee the right level of device and equipment quality, control sequences (PCQ) along the entire normal production cycle and device-selection procedures have been introduced.

In addition, under normal operating conditions, the adoption of precautionary levels constitutes a guarantee against degradation phenomena demonstrated in life tests.

The effectiveness of this approach is confirmed by the first results in terms of reliability obtained from devices already installed, that is, a breakdown rate better than 200 FIT (failure in time =  $10^{-10}$  to the minus ninth degree breakdowns in time) was recorded over a 3-year observation period.

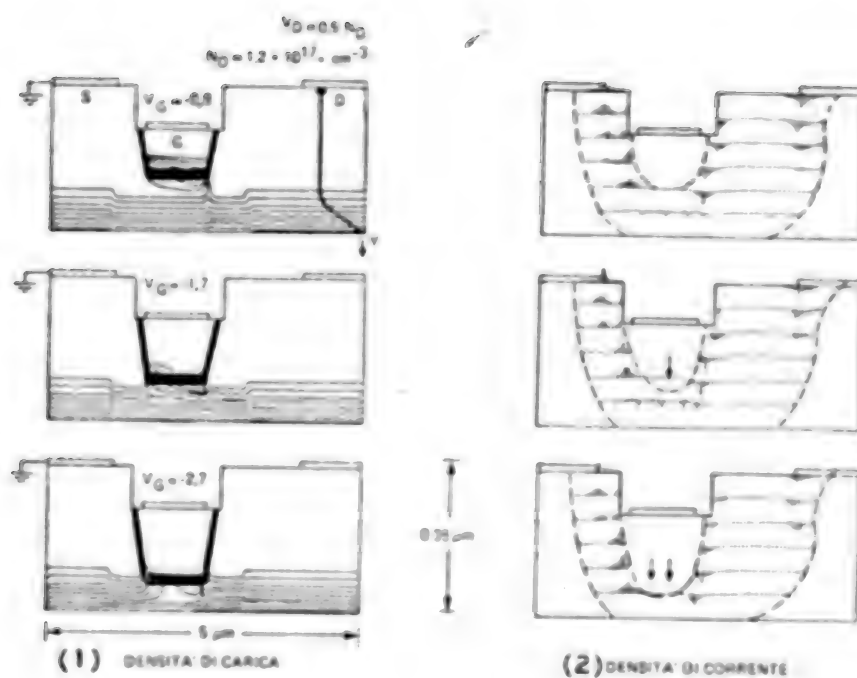
Figure 14 Cross-section of power MESFET with recessed channel structure



Key

- 1. Metal
- 2. Semiconductor substrate

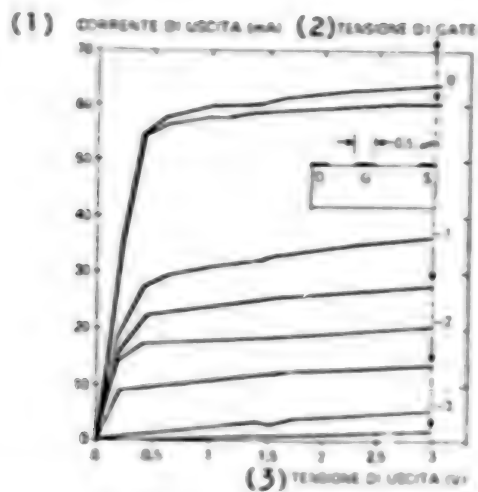
Figure 16 Two-dimensional model for simulation of GaAs MESFET performance:



**Key:**

1. Charge density
2. Current density

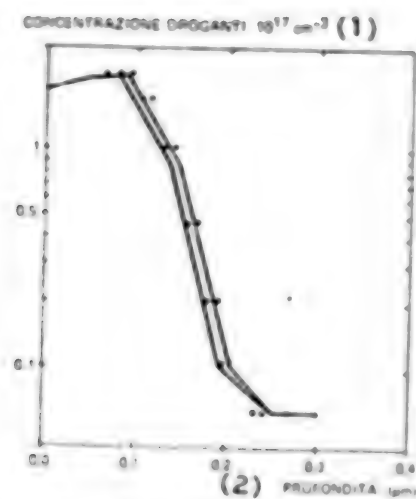
Figure 17 Theoretical concentration profiles used to calculate characteristics of figure 18



Key:

1. Output current
2. Gate voltage
3. Output voltage

Figure 18 I-V characteristics associated with the two theoretical profiles in figure 17



Key:

1. Dope concentration
2. Depth

Table 4 MESFET characteristics

(2) Designation	(1) Parameters								
	Idss (mA)		Gm (mS)		Vp (V)		Iqss (μA)	Ro (rC/W)	
	min	max	min	max	min	max	max	min	max
TA0001-70	60	100	20	—	-2	-6	-50	—	100
TA0121-67	140	220	40	—	-2.5	-5.5	-100	—	70
TA0001-67	600	900	160	—	-2	-4.5	-500	—	20
TC1101-61	600	900	200	—	-1	-3.5	-500	—	20

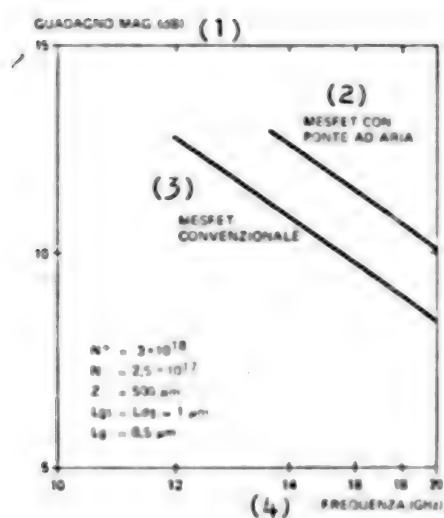
Designation	Parameters					
	Bias		Po	Pa	Pav	G, dB/cp
	Vds (V)	Ibs (mA)	(GHz)	(dBm)	(dBm)	(dB)
TA0001-70	8	40	8	9	> 18	> 9
TA0121-67	8	80	8	14	> 22	> 8
TA0001-67	10	250	12	30	> 27	> 7
TC1101-61	10	200	8	25	> 30.5	> 5.5

Key:

1. DC parameters
2. Device



Figure 23 Comparison between the measured characteristics of MESFET with bridge and [those] of conventional devices



Key:

1. Maximum available gain (in decibels)
2. MESFET with air bridge
3. Conventional MESFET
4. Frequency (gigahertz)

Figure 24 GaAs monolithic amplifier at intermediate frequency operating around 1 gigahertz

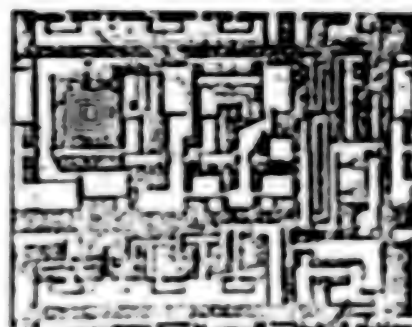


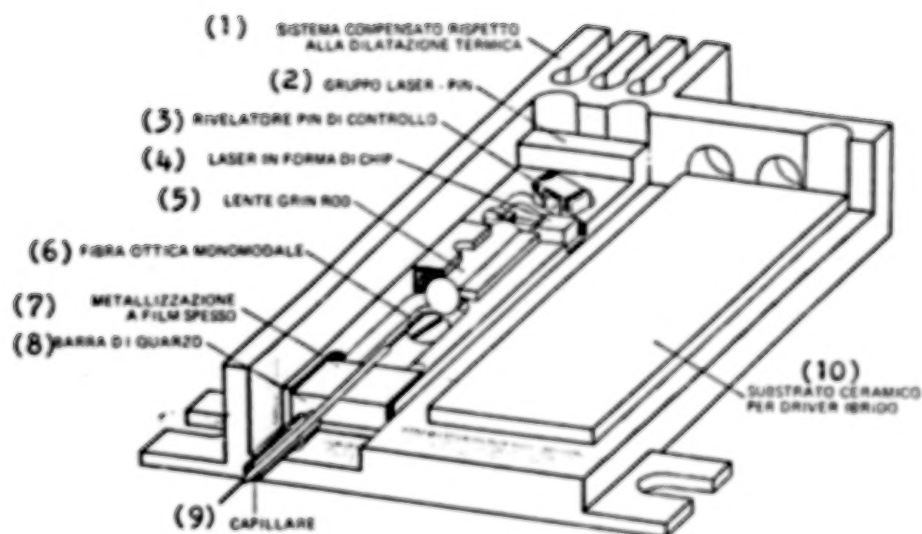
Table 6 Typical performances of the 565 MHz APD-FET receiver

Sensitivity (1)	-37 dBm
Length of band (2)	100 MHz
Gain (3)	12 dB

Key:

1. Sensitivity
2. Bandwidth
3. Typical gain (APD excluded)

Figure 29 Diagram of the container of the 2.4 GHz transmitter module



Key:

- |                                       |   |
|---------------------------------------|---|
| 1. Compensator for thermal dilatation | 6. Monomodal optical fiber              |
| 2. Group laser-pin                    | 7. Thick-film metallization             |
| 3. Control pin detector               | 8. Quartz bar                           |
| 4. Chip-shaped laser                  | 9. Capillary                            |
| 5. Grin rod lens                      | 10. Ceramic substrate for hybrid driver |

Table 7 Importance of GaAs devices in radio link systems produced by Telettra

(2)	(1) Periodo				
	1975-1977	1979-1981	1982-1984	1985-1987	1988-1989
Percentuale dei trasmettitori edittanti dispositivi GaAsFET	10%	20%	70%	90%	100%
Numero di FET (3) per ricevitore	1	2	4-6	10-12	15-25
Peso del costo dei dispositivi sul totale del ricevitore (4)	2%	6%	10-15%	10-25%	15-25%
Incidenza del tasso di guasto dei GaAsFET sul tasso di guasto totale del ricevitore (5)	1%	1-5%	2-25%	10-25%	20-30%

Key:

1. Time period
2. Percentage of transceivers using GaAs FET devices
3. Number of FET per transceiver
4. Importance of cost of devices on total cost of transceiver
5. Incidence of GaAs breakdown rate on total transceiver breakdown rate

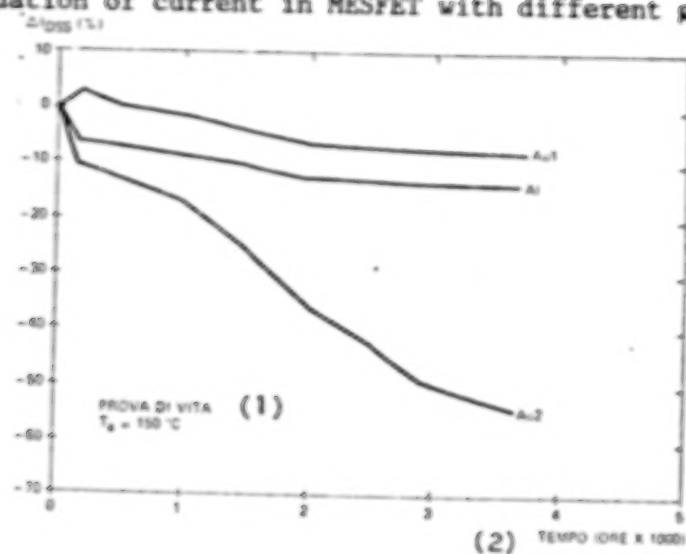
Table 8 Test plan for measurements of reliability

(1) Meccanismo				
(2) Prova	(3) Guasto degradazione di superficie	(4) Degradazione dei contatti ohmici	(5) Degradazione della giunzione Schottky e del canale	(6) Esperimentazione su GaAs
(7) HTS (invecchiamento ad alta temperatura)				
(8) HTOT (vita operativa dc ad alta temperatura)				
(9) HTIB (Prova ad alta temperatura con corrente inversa di GaAs)				(11) Molto efficace
(10) HPFC (Prova ad alta temperatura con alta corrente diretta su GaAs)				(12) Parzialmente efficace

Key:

1. Mechanism
2. Test
3. Degradation of GaAs surface
4. Degradation of ohmic contacts
5. Degradation of Schottky junction and channel
6. Gate electromigration
7. HTS (aging at high temperature)
8. HTOT (DC operating life at high temperature)
9. HTRB (high temperature test with gate reverse current)
10. HPFC (high temperature test with gate high direct current)
11. Very effective
12. Partially effective

Figure 31 Degradation of current in MESFET with different gate structures



Key:

1. Life test
2. Time

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CSO: 5500/M172

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28 May 1987